PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-012406
(43)Date of publication of application : 15.01.2002

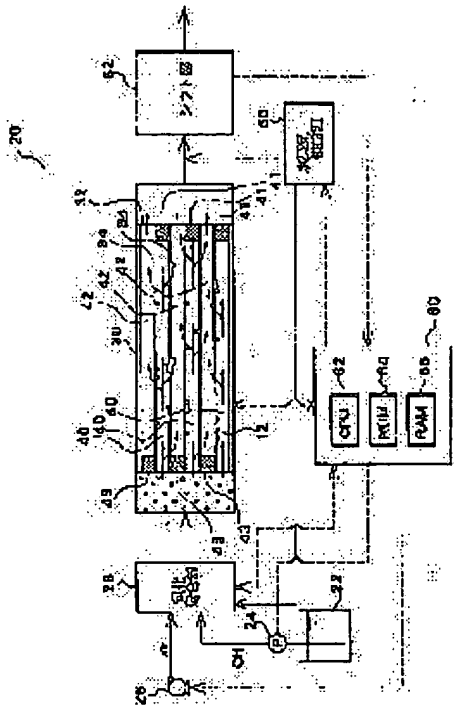
(51)Int.Cl. C01B 3/38
B01J 8/02
B01J 19/24

(21)Application number : 2000-194084
(22)Date of filing : 28.06.2000

(71)Applicant : TOYOTA MOTOR CORP
(72)Inventor : NUMATA KOICHI
IGUCHI SATORU

(54) FUEL REFORMING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an apparatus with improved reforming efficiency and reduction in size by collecting soot in a raw gas and removing it.
SOLUTION: In a honeycomb filter 32 made of a porous material with multiple apertures, a raw gas supply flow pass 40 is formed by closing every other cells with plugs 41 at a down stream end. A filtrated gas flow passage 42 is also formed by closing the balance of cells with plugs 43 at an upper stream end. Reforming catalyst is retained on a surface of a separating wall 34 on a side of the filtrated gas flow pass 42. When the raw gas containing hydrocarbon type fuels is supplied into a reformer 30 and filtered in the honeycomb filter 32, soot 12 in the raw gas is collected in apertures and on a surface of the separating wall 34. The hydrocarbon type fuels are then reformed through the reforming catalyst to become a reformed gas containing hydrogen and carbon monoxide. By increasing a certain amount of air supplied through a blower 26 at a set time interval, the soot 12 collected at the separating wall 34 is burned and removed.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It is the fuel reformer reformed to rich fuel gas. the fuel of a hydrocarbon system -- hydrogen -- It has the reforming filtration member which supports the reforming catalyst which reforms the material gas which is formed of the gap material which mainly has two or more gaps below a predetermined effective diameter, and contains the fuel of the aforementioned hydrocarbon system in one [at least] field to the reformed gas containing hydrogen. A fuel reformer equipped with a reforming means to reform this material gas to the aforementioned reformed gas in case the aforementioned material gas is filtered using the aforementioned reforming filtration member.
[Claim 2] the aforementioned reforming means -- the aforementioned reforming filtration -- the material gas feeder current way which passes the aforementioned material gas to abbreviation parallel along one field of a member, and supplies this material gas to this reforming filtration member, and this reforming filtration -- a fuel reformer [equipped with the filtration raw-gas passage which passes the gas filtered to abbreviation parallel along the field of another side of a member] according to claim 1
[Claim 3] The aforementioned reforming means is a fuel reformer according to claim 2 which comes to constitute the aforementioned reforming filtration member, the aforementioned material gas passage, and the aforementioned filtration raw-gas passage using the monolith support formed of the aforementioned gap material.
[Claim 4] the aforementioned reforming means -- the aforementioned filtration raw-gas passage -- the aforementioned reforming filtration -- the fuel reformer according to claim 2 or 3 which is the means which it comes to arrange in the field which supports the aforementioned reforming catalyst of a member
[Claim 5] The aforementioned reforming filtration member is a fuel reformer according to claim 4 which is the member which comes to carry out inactive processing of the field by the side of the aforementioned material gas passage.
[Claim 6] The aforementioned reforming filtration member is a fuel reformer according to claim 4 which is the member which comes to support the partial oxidation catalyst which carries out partial oxidation of the fuel of the aforementioned hydrocarbon system to the field by the side of the aforementioned material gas passage.
[Claim 7] There is no claim 1 which is the member which it comes to form with the material which has two or more gaps which make the size which can catch the soot which originates in the fuel of the aforementioned hydrocarbon system and is produced in the aforementioned material gas the aforementioned predetermined effective diameter, and the aforementioned reforming filtration member is the fuel reformer of a publication 6 either.
[Claim 8] There is no claim 1 which is 100 micrometers, and the aforementioned predetermined effective diameter is the fuel reformer of a publication 6 either.
[Claim 9] There is no claim 1 which is 50 micrometers, and the aforementioned predetermined effective diameter is the fuel reformer of a publication 6 either.

[Claim 10] There is no claim 1 which is 30 micrometers, and the aforementioned predetermined effective diameter is the fuel reformer of a publication 6 either.
[Claim 11] At the time of predetermined conditions, there is no claim 1 equipped with a material gas manufacture means to prepare the aforementioned material gas so that the rate of a predetermined rate of the air of the aforementioned material gas may increase, and it is the fuel reformer of a publication 10 either.
[Claim 12] There is no claim 1 which a porous material, mesh-like material, the charge of foam, a nonwoven fabric, or a sintered material comes to form, and the aforementioned reforming filtration member is the fuel reformer of a publication 11 either.
[Claim 13] the fuel of a hydrocarbon system — hydrogen — a fuel reformer equipped with a reforming means to have the reforming catalyst which is the fuel reformer reformed to rich fuel gas, and reforms the material gas containing the fuel of the aforementioned hydrocarbon system to the reformed gas containing hydrogen, and the soot uptake means which carries out the uptake of the soot which may be produced in the aforementioned material gas
[Claim 14] the filtration which the aforementioned soot uptake means is formed of the gap material which mainly has two or more gaps below a predetermined effective diameter, and filters the aforementioned material gas — the fuel reformer according to claim 13 which is a member
[Claim 15] The aforementioned filtration member is a fuel reformer according to claim 14 which the aforementioned reforming catalyst is supported to one [at least] field, and is the member of the aforementioned reforming means which presupposes a part and functions at least.
[Claim 16] There is no claim 13 equipped with a soot removal means to remove the soot which carried out the uptake by the aforementioned soot uptake means, and it is the fuel reformer of a publication 15 either.
[Claim 17] The aforementioned soot removal means is a fuel reformer according to claim 16 which is a means to supply the oxygen content gas which contains oxygen for the soot in which the uptake was carried out by the aforementioned soot uptake means.
[Claim 18] There is no claim 1 which is a gasoline and the fuel of the aforementioned hydrocarbon system is the fuel reformer of a publication 17 either.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention — a fuel reformer — being related — detailed — the fuel of a hydrocarbon system — hydrogen — it is related with the fuel reformer reformed to rich fuel gas
[0002]
[Description of the Prior Art] Conventionally, as this kind of a fuel reformer, while burning completely the abbreviation half of the fuel of a hydrocarbon system, what carries out the partial oxidation reaction of the remaining half is proposed (for example, JP,7-215702,A etc.). With this equipment, by shifting to hydrogen and a carbon dioxide the steam produced by perfect combustion, and the carbon monoxide produced by the partial oxidation reaction by the water gas shift reaction, while aiming at improvement in hydrogen yield, generation of soot is suppressed.
[0003]
[Problem(s) to be Solved by the Invention] However, in such a fuel reformer, it is difficult to suppress generating of soot completely. Also as what burns the fuel of a hydrocarbon system completely as theoretical air fuel ratio From a difficult thing, always holding the state of perfect theoretical air fuel ratio according to the error of the meter accompanying that perfect combustion cannot be produced in all the portions of the mixed state while making the fuel and air of a hydrocarbon system into the perfect mixed state, supply of the fuel of a hydrocarbon system, or air supply It will originate in the carbon of the fuel of a hydrocarbon system, and some soot will be generated. Although generating of soot shall be suppressed in the above-mentioned fuel reformer by supplying more [a little] air than theoretical air fuel ratio to the fuel of the hydrocarbon system which carries out perfect combustion, it is not easy to make perfect combustion perform by all the parts of to acquire the perfect mixed state also by this case and the mixed state. Moreover, with this equipment, regulation of air required for a latter partial oxidation reaction will also become difficult by supplying more [a little] air than theoretical air fuel ratio.
[0004] The fuel reformer of this invention sets to one of the purposes to carry out the uptake of the soot which originates in the carbon of the fuel of a hydrocarbon system and is produced. Moreover, the fuel reformer of this invention sets to one of the purposes to remove the soot which carried out the uptake. furthermore, the material gas in which the fuel reformer of this invention contains the fuel of a hydrocarbon system — efficient — hydrogen — it sets to reform to rich fuel gas to one of the purposes Or the fuel reformer of this invention sets to attain the miniaturization of equipment to one of the purposes.
[0005]
[A The means for solving a technical problem, and its operation and effect] The fuel reformer of this invention took the following meanses, in order to attain a part of above-mentioned purpose [at least].

[0006] It is the fuel reformer reformed to rich fuel gas. the 1st fuel reformer of this invention — the fuel of a hydrocarbon system — hydrogen — It has the reforming filtration member which supports the reforming catalyst which reforms the material gas which is formed of the gap material which mainly has two or more gaps below a predetermined effective diameter, and contains the fuel of the aforementioned hydrocarbon system in one [at least] field to the reformed gas containing hydrogen. In case you filter the aforementioned material gas using the aforementioned reforming filtration member, let it be a summary to have a reforming means to reform this material gas to the aforementioned reformed gas.
[0007] In case material gas is filtered using the reforming filtration member which supports with the 1st fuel reformer of this this invention the reforming catalyst which reforms the material gas which is formed of the gap material which mainly has two or more gaps below a predetermined effective diameter, and contains the fuel of a hydrocarbon system in one [at least] field to the reformed gas containing hydrogen, material gas is reformed to reformed gas. In case a reforming filtration member is penetrated, the uptake of the soot which may be produced based on the soot which may be produced in case material gas is reformed at reformed gas, and material gas being made into an elevated temperature is carried out. Therefore, according to the 1st fuel reformer of this invention, the uptake of the soot which may be produced based on the soot which may be produced in case material gas is reformed, and material gas being made into an elevated temperature can be carried out. Moreover, since positive contact for material gas and a reforming catalyst can be aimed at by filtering material gas by the reforming filtration member which supports a reforming catalyst to one [at least] field, while being able to promote the reforming reaction by the reforming catalyst more, the miniaturization of a reforming means, i.e., the miniaturization of equipment, can be attained.
[0008] the 1st fuel reformer of such this invention — setting — the aforementioned reforming means — the aforementioned reforming filtration — the material gas feeder current way which passes the aforementioned material gas to abbreviation parallel along one field of a member, and supplies this material gas to this reforming filtration member, and this reforming filtration — it shall have the filtration raw-gas passage which passes the gas filtered to abbreviation parallel along the field of another side of a member if it carries out like this — reforming filtration — the filtration area of a member can be taken greatly Moreover, since contact to the gas after filtration and a filtering area can also be aimed at, even when the fuel of an unreacted hydrocarbon system exists in the gas after filtration, a reforming reaction can be produced by contact to a filtering area. In the 1st fuel reformer of this invention of this mode, the aforementioned reforming means shall come to constitute the aforementioned reforming filtration member, the aforementioned material gas passage, and the aforementioned filtration raw-gas passage using the monolith support formed of the aforementioned gap material. if it carries out like this — reforming filtration — while being able to take the filtration area of a member greatly, much more miniaturization of a reforming means can be attained
[0009] the 1st fuel reformer of this invention of the mode which a reforming means equips with a material gas feeder current way and filtration raw-gas passage — setting — the aforementioned reforming means — the aforementioned filtration raw-gas passage — the aforementioned reforming filtration — it shall be the means which it comes to arrange in the field which supports the aforementioned reforming catalyst of a member If it carries out like this, the reforming reaction by contact to the filtering area in the case of existing the fuel of an unreacted hydrocarbon system in the gas after filtration can be produced more effectively.
[0010] such filtration raw-gas passage — reforming filtration — in the 1st fuel reformer of this invention of the mode which it comes to arrange in the field which supports the reforming catalyst of a member, the aforementioned reforming filtration member shall be a member which comes to carry out inactive processing of the field by the side of the aforementioned material gas passage if it carries out like this — reforming filtration — the unexpected reaction by the side of the material gas passage of a member can be prevented moreover, filtration raw-gas passage — reforming

filtration — in the 1st fuel reformer of this invention of the mode which it comes to arrange in the field which supports the reforming catalyst of a member, the aforementioned reforming filtration member shall be a member which comes to support the partial oxidation catalyst which carries out partial oxidation of the fuel of the aforementioned hydrocarbon system to the field by the side of the aforementioned material gas passage if it carries out like this — reforming filtration — the partial oxidation reaction of the fuel of a hydrocarbon system can be made to perform by the material gas passage side of a member

[0011] In the 1st fuel reformer of this invention, the aforementioned reforming filtration member shall be a member which it comes to form with the material which has two or more gaps which make the size which can catch the soot which originates in the fuel of the aforementioned hydrocarbon system and is produced in the aforementioned material gas the aforementioned predetermined effective diameter. If it carries out like this, soot can be caught effectively.

[0012] In the 1st fuel reformer of this invention, it is selectable in various things, such as 1000 micrometers and 500 micrometers, 100 micrometers, 70 micrometers, 50 micrometers, 30 micrometers, 20 micrometers, and 10 etc. micrometers, as the aforementioned predetermined effective diameter of the gap material which forms a reforming filtration member. What is necessary is just to form a reforming filtration member by the gap material of the effective diameter according to the particle size of the soot produced by a kind, a service condition, etc. of fuel of the hydrocarbon system contained in material gas.

[0013] Moreover, in the 1st fuel reformer of this invention, it shall have a material gas manufacture means to prepare the aforementioned material gas so that the rate of a predetermined rate of the air of the aforementioned material gas may increase, at the time of predetermined conditions. If it carries out like this, combustion removal of the soot caught by the reforming filtration member can be carried out. the time of carrying out predetermined-time progress, after only the last predetermined rate ended the manufacture whose rate of air increases on "predetermined conditions" here, and reforming filtration — when the pressure deflection of the upper section of a member and a downstream becomes beyond a predetermined value, the time of the predetermined time after starting of equipment passing etc. is included Moreover, the increase in a constant rate, the increase in a predetermined time, etc. are included in "only a predetermined rate is ."

[0014] Furthermore, in the 1st fuel reformer of this invention, a porous material, mesh-like material, the charge of foam, a nonwoven fabric, or a sintered material shall come to form the aforementioned reforming filtration member.

[0015] the 2nd fuel reformer of this invention — setting — the fuel of a hydrocarbon system — hydrogen — it is the fuel reformer reformed to rich fuel gas, and let it be a summary to have a reforming means to have the reforming catalyst which reforms the material gas containing the fuel of the aforementioned hydrocarbon system to the reformed gas containing hydrogen, and the soot uptake means which carries out the uptake of the soot which may be produced in the aforementioned material gas

[0016] According to the 2nd fuel reformer of this this invention, since the uptake of the soot which may be produced in material gas by the soot uptake means is carried out, it is avoidable un-arranging in processing of the latter part with soot. Here, the soot which may be produced based on the soot which may be produced in case material gas is reformed at reformed gas, and material gas being made into an elevated temperature is contained in "the soot which may be produced in material gas."

[0017] the filtration which the aforementioned soot uptake means is formed in the 2nd fuel reformer of such this invention of the gap material which mainly has two or more gaps below a predetermined effective diameter, and filters the aforementioned material gas — it shall be a member Here, as a predetermined effective diameter, it is selectable in various things, such as 1000 micrometers and 500 micrometers, 100 micrometers, 70 micrometers, 50 micrometers, 30 micrometers, 20 micrometers, and 10 etc. micrometers. What is necessary is just to define a predetermined effective

diameter according to the particle size of the soot produced by a kind, a service condition, etc. of fuel of the hydrocarbon system contained in material gas. In the 2nd fuel reformer of this invention of this mode, the aforementioned filtration member shall support the aforementioned reforming catalyst to one [at least] field, and shall be a member of the aforementioned reforming means which presupposes a part and functions at least. Since the reforming reaction by the reforming catalyst can be made to perform while being able to carry out the uptake of the soot in case material gas is filtered by the filtration member if it carries out like this, the miniaturization of equipment can be attained.

[0018] Moreover, in the 2nd fuel reformer of this invention, it shall have a soot removal means to remove the soot which carried out the uptake by the aforementioned soot uptake means. If it carries out like this, since the soot which carried out the uptake will be removed, a soot uptake means can be used continuously. In the 2nd fuel reformer of this invention of this mode, the aforementioned soot removal means shall be a means to supply the oxygen content gas which contains oxygen for the soot in which the uptake was carried out by the aforementioned soot uptake means. If it carries out like this, fuel removal of the soot in which the uptake was carried out by the soot uptake means can be carried out using oxygen content gas.

[0019] The fuel of the aforementioned hydrocarbon system shall be [in / the 1st of this invention, or the 2nd fuel reformer / including each mode] a gasoline.

[0020]

[Embodiments of the Invention] Next, the gestalt of operation of this invention is explained using an example. Drawing 1 is the block diagram showing the outline of the composition of the fuel reformer 20 which is one example of this invention. The fuel of the hydrocarbon system from the fuel tank 22 according to a fuel pump 24 so that the fuel reformer 20 of an example may be illustrated The evaporation mixture section 28 which mixes with air or a steam and is made into material gas while receiving supply with the air by for example, (a gasoline etc. and Blois) 26, and the steam from the steam source of supply 50 and evaporating the fuel of a hydrocarbon system, The reforming section 30 which reforms material gas to the reformed gas containing hydrogen and a carbon monoxide, It has the shift section 52 which shifts to hydrogen and a carbon dioxide the steam and carbon monoxide in the mixed gas of the steam and reformed gas which are supplied from the steam source of supply 50, and the electronic control unit 60 which controls the whole equipment. Since the nucleus of this invention is in the structure of the reforming section 30, and manufacture of the material gas supplied to the reforming section 30, it explains focusing on the composition of the reforming section 30, and manufacture of material gas, and the detailed explanation about the other composition etc. is omitted. In addition, at the fuel reformer 20 of an example, using a gasoline as fuel of a hydrocarbon system, the reforming section 30 is operated at about 600-1000 degrees C which a reforming catalyst activates, and the shift section 52 is operated at about 200-600 degrees C which a water-gas-shift-reaction catalyst activates.

[0021] The reforming section 30 An effective diameter by the porous materials (for example, ceramics, such as a metallic oxide, foam-metal material, mesh-like material, etc.) which have two or more gaps 100 micrometers or less While closing the outlet side (drawing 1 Nakamigi side) of the gas of the cell of the half of the honeycomb tube as formed monolith support with a plug 41 and forming the material gas feeder current way 40 It has the honeycomb filter 32 which closed the entrance side (left-hand side in drawing 1) of the gas of the cell of the remaining half with the plug 43, and formed the filtration raw-gas passage 42. It is arranged so that the material gas feeder current way 40 and the filtration raw-gas passage 42 may adjoin on both sides of a septum 34, and the material gas supplied from the material gas feeder current way 40 penetrates a septum 34, and is discharged from the filtration raw-gas passage 42.

[0022] Drawing 2 is the extention mimetic diagram in which expanding the septum 34 of the honeycomb filter 32, and showing it typically. Coating 36 by inactive material, such as an alumina, is given to the front face of the septum 34 of the honeycomb filter 32, and the reforming catalysts (for

example, platinum (Pt), palladium (Pd), a rhodium (Rh), nickel (nickel), etc.) 38 which reform the fuel of a hydrocarbon system to the reformed gas containing hydrogen and a carbon monoxide are supported at the filtration raw-gas passage 42 side of the front face by the side of the filtration raw-gas passage 42, and two or more gaps so that it may illustrate. Therefore, in case the material gas supplied from the material gas feeder current way 40 penetrates a septum 34 as a filtering medium, it produces a reforming reaction on the reforming catalyst 38 supported at the reforming catalyst [which was supported by the gap of a septum 34] 38, and filtration raw-gas passage 42 side. Even if the material gas feeder current way 40 and the filtration raw-gas passage 42 serve as the case where the fuel of an unreacted hydrocarbon system exists in the gas which penetrated the septum 34 since they are formed in parallel along with the septum 34 on both sides of the septum 34 as shown in drawing 1 It becomes reformed gas which the fuel of an unreacted hydrocarbon system produces a reforming reaction by contact for the reforming catalyst 38 supported by the midst which is flowing the filtration raw-gas passage 42 at the filtration raw-gas passage 42 side of a septum 34, and contains hydrogen and a carbon monoxide.

[0023] Although two or more gaps of a septum 34 set the effective diameter to 100 micrometers or less in the example, this is for catching the soot 12 whose particle size which originates in the carbon which constitutes a gasoline and is produced is about dozens of micrometers by the septum 34, when air is mixed to the gasoline as fuel of a hydrocarbon system and it considers as the temperature of 600-1000 degrees C. Let 1000 micrometers, 500 micrometers, 100 micrometers, 70 micrometers, 50 micrometers, 30 micrometers, 20 micrometers, 10 etc. micrometers of effective diameters of the gap of a septum 34, etc. be various effective diameters that what is necessary is just to set according to the particle size of the soot produced by the service condition of the mixed state by the fuel and the evaporation mixture section 28 of a hydrocarbon system to be used, and the reforming section 30 etc.

[0024] The electronic control unit 60 is constituted as a microprocessor centering on CPU62, and is equipped with ROM64 which memorized the processing program, RAM66 which memorizes data temporarily, and input/output port (not shown). Signals showing the operational status of the evaporation mixture section 28, the reforming section 30, and the shift section 52, such as temperature and a flow rate, are inputted into this electronic control unit 60 through input port. Moreover, from the electronic control unit 60, the driving signal to a fuel pump 24, the driving signal to Blois 26, the control signal to the evaporation mixture section 28, the reforming section 30, or the shift section 52, the driving signal to the steam source of supply 50, etc. are outputted through the output port.

[0025] Next, operation of the fuel reformer 20 of the example constituted in this way especially the uptake of the soot 12 in the reforming section 30 and the situation of a reforming reaction, and the situation of the removal of soot 12 which carried out the uptake are explained. The uptake of soot 12 and the situation of a reforming reaction in the reforming section 30 were explained when explaining the composition of the reforming section 30. That is, in case material gas is filtered with the honeycomb filter 32, while catching the soot 12 contained in material gas the front face of two or more gaps formed in the septum 34 of the honeycomb filter 32, or inside a gap, the fuel of the hydrocarbon system contained in material gas on the reforming catalyst 38 supported by the front face of two or more gaps formed in the septum 34 and the front face by the side of the filtration raw-gas passage 42 is reformed to the reformed gas containing hydrogen and a carbon monoxide. In addition, even if it becomes the case where the fuel of an unreacted hydrocarbon system exists in the gas which penetrated the septum 34, the fuel of an unreacted hydrocarbon system contacts the reforming catalyst 38 supported by the midst which is flowing the filtration raw-gas passage 42 at the filtration raw-gas passage 42 side of a septum 34, produces a reforming reaction, and is reformed at the reformed gas containing hydrogen and a carbon monoxide.

[0026] Removal of soot 12 which carried out the uptake by the septum 34 of the honeycomb filter 32 is performed by performing the soot removal routine illustrated to drawing 3 . This routine is

repeatedly performed for every (every [for example,] 2 hours) predetermined time. If a soot removal routine is performed, CPU62 of an electronic control unit 60 will output a driving signal to Blois 26 so that only the specified quantity may increase the air content introduced into the evaporation mixture section 28 from Blois 26 (Step S100). And processing which waits to carry out predetermined-time progress (Step S102), and returns the introductory air content which increased to the original air content is performed (Step S104), and this routine is ended. An increase of an introductory air content supplies the material gas which the rate of air increased to the honeycomb filter 32. Since the soot 12 caught by the front face or gap of a septum 34 of the honeycomb filter 32 is a carbon particle, it burns by the oxygen in air, serves as a carbon dioxide, and is penetrated and removed at the filtration raw-gas passage 42 side. Therefore, the predetermined time of Step S102 is set up in consideration of time required for combustion while repeating and performing a soot removal routine and supplying the air content which can carry out combustion removal of all the soot 12 caught by the septum 34, or its most.

[0027] According to the fuel reformer 20 of an example explained above, by filtering material gas with the honeycomb filter 32 with which an effective diameter has two or more gaps 100 micrometers or less, and supports the reforming catalyst 38, while catching the soot 12 contained in material gas, material gas can be reformed to the reformed gas which contains hydrogen and a carbon monoxide efficiently. And since the material gas feeder current way 40 and the filtration raw-gas passage 42 were formed in parallel along with the septum 34 on both sides of the septum 34, even if it becomes the case where the fuel of an unreacted hydrocarbon system exists in the gas after filtration, a reforming reaction can be produced by contact for the reforming catalyst 38 supported at the filtration raw-gas passage 42 side of a septum 34. Moreover, since the big honeycomb filter 32 of a filtration area is used, the miniaturization of the reforming section 30, i.e., the miniaturization of equipment, can be attained.

[0028] Moreover, according to the fuel reformer 20 of an example, combustion removal of the soot 12 caught by the septum 34 of the honeycomb filter 32 can be carried out by performing a soot removal routine for every predetermined time. Since it carries out by increasing the rate of air [in / material gas / for removal of soot 12], it is not necessary to stop operation of equipment for removal of soot 12.

[0029] Although the front face by the side of the filtration raw-gas passage 42 of the gap formed in the septum 34 of the honeycomb filter 32 and the front face by the side of the filtration raw-gas passage 42 of a septum 34 were made to support the reforming catalyst 38 with the fuel reformer 20 of an example It is good also as a thing which makes the reforming catalyst 38 support also all over a gap, and is good also as a thing which also makes the front face by the side of the material gas feeder current way 40 of a septum 34 support the reforming catalyst 38.

[0030] In the fuel reformer 20 of an example, although coating 36 by inactive material, such as an alumina, was given to the front face by the side of the material gas feeder current way 40 of the septum 34 of the honeycomb filter 32, it is good also as what does not give coating 36. Moreover, as shown in septum 34of honeycomb filter 32B of modification of drawing 4 B the front face by the side of the material gas feeder current way 40 of septum 34of honeycomb filter 32B B — a partial oxidation reaction — high — activity — a partial oxidation catalyst (For example, platinum (Pt), palladium (Pd), etc.) while supporting 46 — the filtration raw-gas passage 42 side of septum 34B — the steam-reforming reaction of the fuel of a hydrocarbon system — high — it is good also as what supports the activity reforming catalysts (for example, a rhodium (Rh), nickel (nickel), etc.) 48 In honeycomb filter 32B of this modification, the heat of reaction by the partial oxidation produced on the partial oxidation catalyst 46 is supplied to the reforming catalyst 48 which adjoined directly with the propagation in septum 34B, and the sensible heat of gas, and is used for the steam-reforming reaction produced on the reforming catalyst 48. That is, the heat of reaction by partial oxidation can be used for the steam-reforming reaction which arises on the reforming catalyst 48, without being spoiled by the thermolysis to the reactor exterior etc.

[0031] Although a reforming reaction shall be produced in the fuel reformer 20 of an example while catching soot 12 with the honeycomb filter 32, it is good also as what produces only a reforming reaction with the honeycomb filter 32. In this case, it is good also as what equips the upstream of the honeycomb filter 32 with the soot removal filter which catches soot 12, and is good also as what is not equipped with a soot removal filter. The flexibility of the effective diameter of the gap of a septum 34 becomes large by any case.
[0032] In the fuel reformer 20 of an example, although the honeycomb filter 32 was used, as long as it is the member which can be filtered, what member is sufficient. For example, it is good also as structure which carries out two or more laminatings and becomes so that the septum formed by the porous material of a sheet metal-like material gas feeder current way and sheet metal-like filtration raw-gas passage may be pinched.
[0033] Although combustion removal of the soot 12 which performed the soot removal routine for every (every [for example,] 2 hours) predetermined time, and was caught by the septum 34 shall be carried out in the fuel reformer 20 of an example, when after [a warming-up end] predetermined-time progress is carried out, it is good for starting of the fuel reformer 20 also as what performs a soot removal routine. Moreover, although the soot 12 which performed the soot removal routine as a processing program by the electronic control unit 60, increased the introductory air content by Blois 26, and was caught by the septum 34 was removed in the fuel reformer 20 of an example, when predetermined-time progress is carried out using a timer, it is good also as what removes soot 12 mechanically so that only the specified quantity may supply air to the reforming section 30.
[0034] In the fuel reformer 20 of an example, although explained using a gasoline as fuel of a hydrocarbon system, it is applicable to the fuel reformer using the fuel of the shape of gas and liquefied various hydrocarbon systems, such as alcohols, such as unsaturated hydrocarbons, such as saturated hydrocarbons and ethylene, such as the fuel of hydrocarbon systems other than a gasoline, for example, methane, and ethane, and a propylene, a methanol, and ethanol. In this case, it is applicable also to that by which soot is not contained in material gas as well as that by which soot is contained in material gas. Moreover, although a water gas shift reaction shall be performed after a reforming reaction in the fuel reformer 20 of an example, using a gasoline as fuel of a hydrocarbon system, when using the fuel of a gas-like hydrocarbon system, it is not necessary to form the shift section 52 by the fuel reformer of a type which is unnecessary as for evaporation and performs a reforming reaction and a water gas shift reaction simultaneously in the evaporation mixture section 28.
[0035] As mentioned above, although the gestalt of operation of this invention was explained using the example, as for this invention, it is needless to say that it can carry out with the gestalt which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

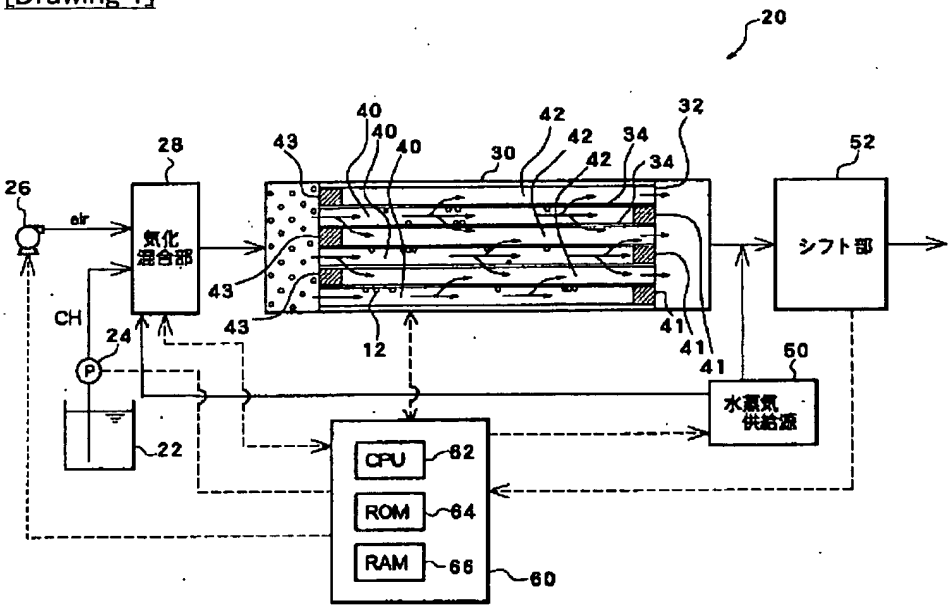
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the outline of the composition of the fuel reformer 20 which is one example of this invention.
[Drawing 2] It is the extention mimetic diagram in which expanding the septum 34 of the honeycomb filter 32, and showing it typically.
[Drawing 3] It is the flow chart which shows an example of the soot removal routine performed by the electronic control unit 60 of the fuel reformer 20 of an example.
[Drawing 4] It is the extention mimetic diagram which expands septum 34of honeycomb filter 32B of modification B, and is shown typically.
[Description of Notations]
12 Soot, 20 Fuel Reformer, 22 Fuel Tank, 24 Fuel Pump, 26 Blois, 28 The evaporation mixture section, 30 32 The reforming section, 32B Honeycomb filter, 34 34B A septum, 36 Coating, 38 Reforming catalyst, 40 A material gas feeder current way, 41 A plug, 42 Filtration raw-gas passage, 43 A plug, 46 A partial oxidation catalyst, 48 A reforming catalyst, 50 A steam source of supply, 52 The shift section, 60 An electronic control unit, 62 CPU, 64 ROM, 66 RAM.

[Translation done.]

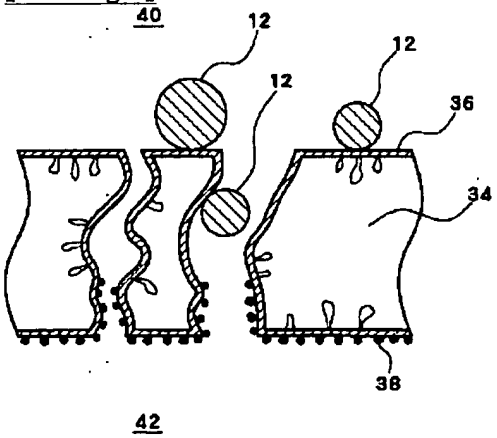
* NOTICES *

DRAWINGS

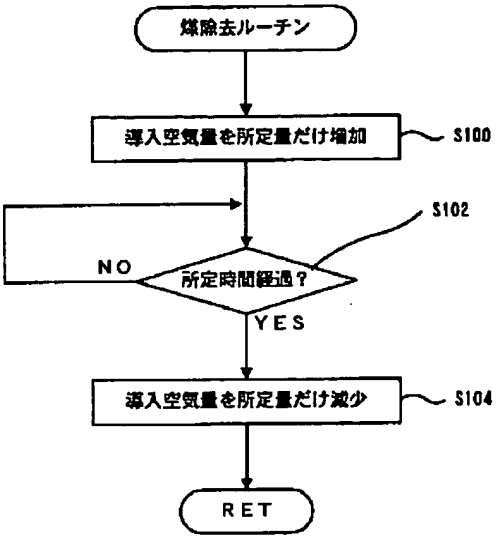
[Drawing 1]



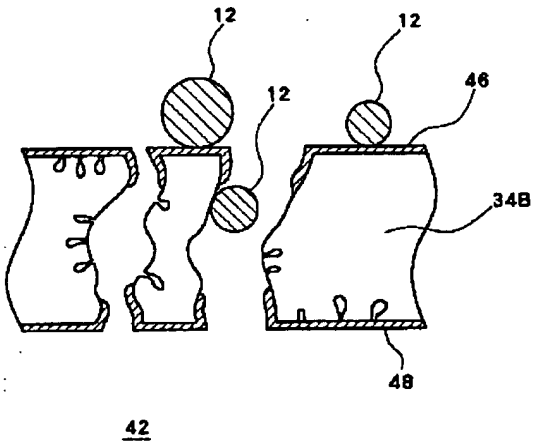
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]